

## (12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
4 November 2004 (04.11.2004)

PCT

(10) International Publication Number  
**WO 2004/095605 A2**

(51) International Patent Classification<sup>7</sup>: H01M

(21) International Application Number:  
PCT/US2004/012635

(22) International Filing Date: 22 April 2004 (22.04.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/464,874 22 April 2003 (22.04.2003) US  
60/500,123 3 September 2003 (03.09.2003) US

(71) Applicant and  
(72) Inventor: IACOVELLI, Benedetto, Anthony [US/US];  
172 Beaverdam Road, Asheville, NC 28804 (US).

(74) Agents: HAMILTON, Jennifer, H. et al.; The Eclipse  
Group, 10453 Raintree Lane, Northridge, CA 91326 (US).

(81) Designated States (unless otherwise indicated, for every  
kind of national protection available): AE, AG, AL, AM,

AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,  
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,  
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,  
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,  
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,  
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,  
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,  
ZW.

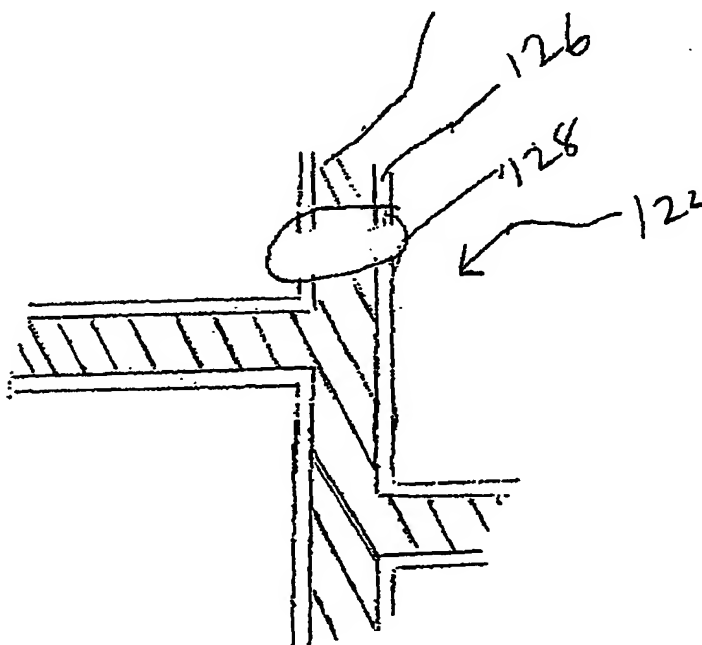
(84) Designated States (unless otherwise indicated, for every  
kind of regional protection available): ARIPO (BW, GH,  
GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),  
Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), Euro-  
pean (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR,  
GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK,  
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,  
ML, MR, NE, SN, TD, TG).

**Published:**

— without international search report and to be republished  
upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guid-  
ance Notes on Codes and Abbreviations" appearing at the begin-  
ning of each regular issue of the PCT Gazette.

(54) Title: FUEL CELL, COMPONENTS AND SYSTEMS



(57) Abstract: Alkali fuel cells, systems, and re-  
lated methods, and flow-through, high-surface area  
electrodes, are employed to generate electricity. The  
electrode can include a porous substrate comprising  
a first side for fluid ingress, a second side for fluid  
egress, and a plurality of walls oriented in different  
directions between the first and second sides. Voids  
can be defined between the walls. The walls can  
include surfaces and micro-scale pores. A multi-di-  
rectional fluid flow path can be defined between the  
first and second sides. A thin film comprising a cat-  
alytic material can be disposed on the surfaces. A  
fuel/electrolyte mixture can be flowable generally  
from the first side, through the voids and the pores  
of the substrate and in contact with the thin film, and  
to the second side. Additives can be included for re-  
freshing the electrolyte and/or the electrode. A wa-  
ter/thermal/pressure management system includes a  
permeable membrane from which water can be re-  
moved from a fluid while retaining fuel and/or elec-  
trolyte in the fluid. The electrolyte can include an  
additive that cleans the electrodes. A refresh cycle  
can be implemented in which one or more electrodes  
are operated in a mode that refreshes catalytic ma-  
terial of the electrode.